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ABSTRACT

This publication provides the evaluation policies, procedures, and standards to which a compressed natural gas (CNG) and liquefied petroleum gas (LPG) technician training program must adhere to be granted certification by the National Institute for Automotive Service Excellence. The policies section has three parts: the automobile areas that may be certified and minimum requirements for certification; information about evaluation team leaders, on-site evaluation team members, task lists, tools and equipment, and automobile program evaluation; and discussion of policies on articulation agreements, recognition for certification, appeals and action for revocation. The procedures section provides an overview of the process for certification. The next section contains the 10 program standards in these areas: purpose, administration, learning resources, finances, student services, instruction, equipment, facilities, instructional staff, and cooperative agreements. The task list follows. Lists of assumptions and definitions are provided. The tasks are divided into these areas: electrical/electronic systems, engine performance, LPG diagnosis and repair, LPG maintenance, LPG conversion/installation, CNG diagnosis and repair, CNG maintenance, and CNG conversion/installation. Lists are also provided of applied academics (language arts and communications, mathematics, science) and workplace skills. The final section lists tools and equipment, including hand tools, general lab/shop equipment, and specialty tools and equipment. (YLB)

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ASE PROGRAM CERTIFICATION STANDARDS

LIGHT/MEDIUM DUTY CNG/LPG

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CE 070 535

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ASE CERTIFICATION

FOR

LIGHT/MEDIUM DUTY

CNG/LPG TRAINING PROGRAMS

Administered By:

National Automotive Technicians Education Foundation (NATEF)
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POLICIES

COMPRESSED NATURAL GAS (CNG) AND LIQUEFIED PETROLEUM GAS (LPG) TECHNICIAN TRAINING CERTIFICATION PROGRAM

The Board of the National Institute for Automotive Service Excellence (ASE) is the responsible body for the Light/Medium-Duty Compressed Natural Gas (CNG) and Liquefied Petroleum Gas (LPG) Technician Training Certification Program. ASE will grant certification to programs that comply with the evaluation procedure, meet established standards, and adhere to the policies in this document.

The certification program is under the direct supervision of the Board of Trustees of the National Automotive Technicians Education Foundation (NATEF) and such personnel who are designated or employed by the Foundation.

The purpose of the CNG/LPG Technician Training Certification Program is to improve the quality of training offered at the secondary and post-secondary levels. NATEF does not endorse specific curricular materials nor provide instruction to individuals, groups or institutions. It does, however, set standards for the content of instruction which includes: tasks, tools and equipment, hours, and instructor qualifications.

The program is a certification program only and it is <u>not</u> associated with the accreditation role of other agencies.

The cost to each program for certification will be as reasonable as possible to encourage program participation. This cost will include: self-evaluation materials, on-site team evaluation materials, and the honorarium and expenses of the Evaluation Team Leader (ETL).

The CNG/LPG areas that may be certified are:

1. Electrical/Electronic Systems
2. Engine Performance
3. LPG Diagnosis and Repair
4. LPG Maintenance
5. LPG Conversion/Installation
6. CNG Diagnosis and Repair
7. CNG Maintenance
8. CNG Conversion/Installation

Programs may certify for LPG only, CNG only, or both LPG and CNG. In any case, areas 1 - 4 are required for minimum certification of LPG programs; while areas 1, 2, 6, & 7 are required for minimum certification of CNG programs.

CNG/LPG MINIMUM PROGRAM REQUIREMENTS

1. The minimum program requirements are identical for initial certification and for recertification.

2. A program providing instruction in all of the CNG/LPG areas must have a minimum total of 730 hours of combined laboratory/shop (co-op) and classroom instruction. Tasks related to the CNG/LPG areas may be taught at different times during the course of study. Therefore, the hours for an individual area would be the sum total of all the hours of instruction related to the tasks. Individual areas must have a minimum of the following hours:

Electrical/Electronic Systems	200
Engine Performance	260
LPG Diagnosis and Repair	70
CNG Diagnosis and Repair	70
LPG Maintenance	25
CNG Maintenance	25
LPG Conversion/Installation	40
CNG Conversion/Installation	40
TOTAL HOURS	730

3. **The average rating on Standards 6, 7, 8, and 9 must be a four (4)** on the five-point scale (see Program Standards section for description of standards). The program will not be approved for an on-site evaluation if the average is less than 4 on those Standards. The program should make improvements before submitting the application to NATEF for review. **A program will be denied certification if the on-site evaluation team average on Standards 6, 7, 8, and 9 is less than four.**

4. A program may not be approved for an on-site evaluation if the average rating on Standards 1 - 5 and 10 is less than a four (4) on the five-point scale. **A program may be denied certification if the on-site evaluation team average on Standards 1 - 5 and 10 is less than four.** Approval for on-site evaluation or certification will be made by

NATEF, based on the number of Standards rated at 4 or 5 as well as the individual rating on any Standard rated below 4.

5. Instructor(s) must hold current ASE certification in the area(s) they are teaching (e.g., A-6, A-8, F-1). Currently, there is no ASE certification for LPG technicians (Oct. 1995).

6. The program Advisory Committee must conduct at least two working meetings a year and have a minimum of 5 people on the committee. Minutes of the meetings must be provided for review by the on-site evaluation team.

7. The Task List is divided into three priority areas. The following guidelines must be followed:

95% of all Priority 1 (P-1) items must be taught in the curriculum.
80% of all Priority 2 (P-2) items must be taught in the curriculum.
50% of all Priority 3 (P-3) items must be taught in the curriculum.

8. The concern for safety is paramount to the learning environment. Each program area has the following safety task requirement preceding all related tasks:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

INFORMATION ABOUT EVALUATION TEAM LEADERS (ETLs)

Evaluation Team Leaders (ETLs) are educators who have been trained by NATEF to lead the on-site evaluation. The ETL will be assigned by the NATEF office once a program has been approved for an on-site evaluation. Every effort will be made to assign an ETL located closest to the school to reduce the cost for the evaluation. Two additional team members, selected by the program and approved by the ETL, are required for a CNG/LPG program on-site evaluation. (See the following page for additional information about team members.)

Persons selected as ETLs must have:

1. a minimum of six years of combined experience as an automotive technician and automotive instructor (at least three years experience as an automotive technician is required - with one of those years including experience with LPG and/or CNG),
2. a B.A. or B.S. in Education from a college or university recognized for teacher training by the state, and
3. ASE certification in <u>all</u> automobile areas (certified master automobile technician) and F-1.

Or, if a state employs CNG/LPG instructors without the preceding requirements, the following qualifications apply:

1. six years experience as an automotive technician - with one of those years including experience with LPG and/or CNG,
2. four years automotive teaching experience at the secondary or post-secondary level,
3. ASE certification in <u>all</u> automobile areas (certified master automobile technician) and F-1.

ETL training is valid for two years. However, automatic two-year renewal is granted every time an ETL conducts an on-site evaluation. ETLs are required to attend additional training sessions if they have not conducted an on-site evaluation in two years. This additional training is required even if the individual holds current ASE certification.

Anyone interested in becoming an Evaluation Team Leader should contact the NATEF office at (703) 713-0100 or their State Trade & Industry Supervisor for more details.

INFORMATION ABOUT ON-SITE EVALUATION TEAM MEMBERS

The program requesting certification is responsible for recruiting and recommending on-site evaluation team members. The ETL must approve individuals recommended by the program. The on-site evaluation team members must be practicing automotive technicians, service managers or shop owners (with CNG/LPG experience) from businesses or fleets in the area served by the training program.

Team members must have:

1. high school diploma or the equivalent (industry or military training may be considered as the equivalent), and
2. at least seven years full-time experience as a general automotive technician.

* ASE certification is recommended but not required.

The certification evaluation team is composed of three individuals: the ETL and two team members. The two team members must be from the automotive industry.

Each program requesting initial certification or recertification must identify their choices for evaluation team members on the On-Site Evaluation Team Member List. An alternate team member choice must be identified on the On-Site Evaluation Team Member List in the event that one of the team members is unable to conduct the on-site evaluation.

Team members must not be advisory committee members, former instructors or graduates of the program within the past ten years.

TASK LIST INFORMATION

An essential element of any curriculum or training program is a valid task list. Automotive instructors need a well-developed task list that serves as a solid base for course of study outlines and facilitates communication and articulation of their training programs with other institutions in the region.

The NATEF Light/Medium-Duty CNG/LPG task lists were developed in 1995 with funding from a cooperative agreement with the U.S. Department of Energy. Between June 20 and August 10, 1995, a national committee was assembled and conducted four, three-day workshops in Herndon, Virginia to identify the standards used in the Light/Medium-Duty CNG/LPG Certification Program. The committee consisted of individuals representing automobile manufacturers, conversion equipment manufacturers, fuel suppliers, CNG/LPG conversion companies, technicians, and educators. All participants have had significant experience with CNG, LPG, or both.

The committee reviewed NATEF program standards, task list, tools and equipment list, program hours, instructor qualifications, and Evaluation Team Leader (ETL) qualifications. The committee also had the most current NATEF automobile task list, the National Institute for Automotive Service Excellence (ASE) Light Vehicle-Compressed Natural Gas task list (F-1) and the American Society for Advanced Fuels Technology (ASAFT) task list for reference purposes.

In defining the CNG/LPG task list for secondary and post-secondary CNG/LPG programs, the committee elected to allow for as much overlap as practical with the Automobile Certification Program. Although an allowance was made for automobile and CNG/LPG programs to overlap, the CNG/LPG Program Certification is a separate, stand alone, certification. Additional information on the development of the NATEF task list can be found in the Task List section.

All tasks have a Priority designation.

- **Ninety-five percent (95%) of Priority 1 (P-1) items must be taught in the curriculum.**
- **Eighty percent (80%) of Priority 2 (P-2) items must be taught in the curriculum.**
- **Fifty percent (50%) of the Priority 3 (P-3) items must be taught in the curriculum.**

TOOLS AND EQUIPMENT INFORMATION

The basic tools and equipment that must be available for use in the CNG/LPG program are listed in the Tools and Equipment section. Many tools and much of the equipment are the same for some or all of the program areas. However, some equipment is specialized and must be available for use in the selected program areas. These individual program area lists are included in the Tools and Equipment section.

The student hand tool list covers all program areas. This list indicates the tools a student will need to own to be successful in each of the specialty areas.

Although no brand names are listed, the equipment and tools must address the following programmatic issues:

1. Safety - Equipment and tools must have all shields, guards, and other safety devices in place and operable.
2. Type and Quality - The tools and equipment used in a certified program must be of the type and quality found in industry. They must also be adequate and in sufficient quantity to meet the program goals and student performance objectives.
3. Consumable Supplies - Supplies should be in sufficient quantity to assure continuous instruction. Consumable supplies, such as solvents, sand paper, etc. are not listed.
4. Maintenance - A preventative maintenance schedule should be used to minimize equipment down-time.
5. Replacement - A systematic schedule for replacement should be used to maintain up-to-date tools and equipment at industry and safety standards. Information gained from student program evaluations as well as advisory committee input should be used in the replacement process.
6. Inventory - An inventory system should be used to account for tools, equipment, parts, and supplies.
7. Parts Purchasing - A systematic parts purchasing system should be used from work order to supplier.
8. Hand Tools - Each student should be encouraged to purchase a hand tool set during the period of instruction.
9. Storage - Adequate storage of tools should be provided. Space for storage of the students' hand tools should be provided.

CNG/LPG PROGRAM EVALUATION

NATEF Standards for Initial Certification and Recertification are identical. Four items are critical for certification and are in **bold** print in the CNG/LPG Program Self-Evaluation materials. These three items are:

2.5 A
6.5 A
7.1 A
7.1 B

Programs must be able to support a yes response for 2.5 A and 6.5 A. Programs must hold at least two working meetings of the Advisory Committee each year (2.5 A). In section 6.5 A, the programs must include the required percentage of the P-1, P-2, and P-3 tasks in the areas where certification is desired. Programs must also achieve a minimum score of 4 on the 5-point scale on item 7.1 A&B. If these responses are not achieved, do not apply for certification at this time.

In addition, an on-site evaluation will not be scheduled unless the average score on Standards 6, 7, 8, and 9 is at least a 4 on the CNG/LPG Program Self-Evaluation. Please refer to the CNG/LPG Minimum Program Requirements for more information.

RECOGNITION FOR CERTIFICATION

A program approved for certification will receive a plaque that bears the ASE seal and the school's name. Individual plates will be attached to the plaque to identify the areas in which the program is certified. These will also include the expiration date of certification. A statement below the seal will read:

> "THE INSTRUCTION, COURSE OF STUDY, FACILITIES AND EQUIPMENT OF THIS INSTITUTION HAVE BEEN EVALUATED BY THE NATIONAL AUTOMOTIVE TECHNICIANS EDUCATION FOUNDATION AND MEET THE NATIONAL INSTITUTE FOR AUTOMOTIVE SERVICE EXCELLENCE STANDARDS OF QUALITY FOR THE TRAINING OF TECHNICIANS IN THE FOLLOWING AREAS:
>
> _____
>
> _____
>
> _____"

Institutions receiving ASE certification are encouraged to put on the graduate's diploma or certificate the following statement:

> "The person holding this diploma has participated in a *CNG/LPG, CNG, or LPG*, technician training program that was certified by the National Institute for Automotive Service Excellence and has completed instruction in the following areas:
>
> _____
>
> _____
>
> _____"

A screened ASE/NATEF logo may be overprinted with the above statement and placed on the graduate's diploma. A camera ready logo is provided in the promotional material a program receives upon certification.

A program approved for recertification will receive a brass plate which reads "RECERTIFIED Exp. 200__".

Certified programs will also receive a 24"x30" sign indicating that the training program is ASE certified.

APPEALS AND ACTION FOR REVOCATION

APPEALS: PROGRAMS APPLYING FOR CERTIFICATION

A complaint received from any school concerning the procedures, evaluation or certification of the CNG/LPG technicians training program must be made in writing to the ASE office in Herndon, VA. It will be immediately referred to the Grievance Examiner who will acknowledge receipt of the complaint, in writing, to the complainants. Thereafter, the Grievance Examiner will investigate the complaint and prepare a report. A copy of the report will be given to the complainants and to an Appeals Committee within thirty (30) days of the receipt of the complaint.

The Appeals Committee will review the findings and recommendations of the Grievance Examiner, together with the complaint and any data supplied in connection therewith. The Appeals Committee will be empowered to dismiss the matter or to initiate such action as they may deem appropriate.

If the complainants desire to review the Appeals Committee's evaluation, they may do so at the office of the Grievance Examiner in Herndon, VA. However, they will not be permitted to make copies of the results.

ACTION FOR REVOCATION: ASE CERTIFIED PROGRAMS

The Appeals Committee will also advise the ASE President of its judgments and recommendations for action in any cases of malpractice or misrepresentation involving the misuse of ASE certification for a CNG/LPG technician training program. Upon receipt of a complaint alleging misuse or misrepresentation by a certified program, the Grievance Examiner will be notified. The Grievance Examiner will notify, in writing, the parties against whom the complaint has been filed, indicating the alleged wrongdoing. The parties will be further advised that they may submit a written explanation concerning the circumstances of the complaint within thirty (30) days. After the Grievance Examiner has considered the complaint and received the explanation, if any, the Grievance Examiner will determine whether there is a reasonable basis for a possible wrongdoing. If the Grievance Examiner finds such a basis, the Grievance Examiner will inform the parties of the findings. At that time, the Grievance Examiner will inform the parties of their right to a hearing before the Appeals Committee. The parties will have fifteen (15) days to notify the Grievance Examiner, in writing, of their decision.

In the event the involved parties elect to be bound by the findings of the Grievance Examiner without a hearing, the Grievance Examiner will submit a written report with recommendations to the Chairman of the Appeals Committee. This report will be submitted within sixty (60) days of the receipt of the waiver of a hearing. The Chairman of the Appeals Committee will mail a copy of the Grievance Examiner's findings and recommendations to the parties.

In the event that the involved parties elect to appear at a hearing, the Chairman of the Appeals Committee will call a Board of Inquiry. This Board will consist of four ASE Board members, one from each of the following categories: Education, Public Interest, Service Employers, and Vehicle and Service Products Manufacturers. The Board of Inquiry will be convened in Herndon, VA at a date and time determined by the Chairman. The Board will notify the involved parties, in writing, regarding the time and place of the hearing.

The Grievance Examiner will be responsible for investigating and presenting all matters pertinent to the alleged wrongdoing to the Board of Inquiry. The involved parties will be entitled to be at the hearings with or without counsel. The parties will be given an opportunity to present such evidence or testimony as they deem appropriate.

The Board of Inquiry will notify the Chairman of the Appeals Committee of its findings and recommendations, in writing, ten (10) days after the hearing is completed.

The Appeals Committee will review the findings and recommendations of either the Grievance Examiner if a hearing was waived or the Board of Inquiry if a hearing was held. The Appeals Committee will determine if the record on the complaint supports a finding of conduct contrary to or in violation of reasonable practices. If two-thirds of the Appeals Committee so find, the Committee will recommend to the President of ASE appropriate sanctions or courses of action against the parties charged.

PROCEDURES FOR CERTIFICATION/RECERTIFICATION

Process Overview

NOTE: NATEF recommends that programs maintain a file containing copies of all reference and documentation materials developed during all phases of the certification process.

1. Purchase application materials

The program requesting certification must purchase self-evaluation materials from NATEF in Herndon, VA. Upon completion of the self-evaluation, the program must return four items from the evaluation materials packet. These four items are:

a. Application for Certification or Recertification
b. Self-Evaluation Summary Sheet
c. On-site Evaluation Team Member List
d. Instructor Qualifications Sheets

2. NATEF review of application

The national office will review the materials within 30 days. Following the review, the program administrator and the state Trade & Industrial Supervisor will be notified about the status of the program. The program will be identified as one of the following:

a. qualified for on-site evaluation for all the specialty areas listed on the application.
b. qualified for on-site evaluation for some but not all specialty areas listed on the application. The program administrator may proceed with the on-site evaluation for the specialty areas that qualify at that time OR make improvements and resubmit the application at a later date.
c. not qualified for an on-site evaluation at that time. NATEF will indicate specific improvements that must be made before the on-site evaluation can be scheduled.

3. Evaluation Team Leader (ETL) assigned, program coordinator makes contacts

In cooperation with state officials, NATEF will assign an Evaluation Team Leader (ETL) to a program. NATEF will also send the program the Application for On-site Evaluation. With a legitimate reason, the program coordinator can contact the NATEF office to request a different ETL. (The ETL assigned must NOT be a present or former teacher or administrator of the program to be evaluated.) The program coordinator must contact the ETL to arrange a date for the on-site evaluation.

The Application for the On-site Evaluation will be sent with instructions that outline the plans for the local administration and the costs for the ETL's services and expenses. These costs will be paid by the institution requesting certification.

4. Send on-site application, course of study, and list of on-site evaluation team members to ETL

The Application for On-site Evaluation must be sent to the ETL, signed by the program administrator. A copy of the course of study and this application must be received by the ETL at least two weeks prior to the on-site evaluation or the on-site must be rescheduled. The course of study should include the following items:

a. syllabus for each class
b. tasks to be taught under each area, specified according to High Priority designations (P-1, P-2, P-3)
c. number of contact hours for each area (Tasks may be taught at different times in the program or in more than one area. However, the hours for the tasks may be counted only once.)
d. areas and sequence of instruction to be included in the program
e. list of training materials and audio-visual materials used in training
f. sample evaluation form used to track student progress

Include the On-site Evaluation Team Member List for the ETL to review and approve. Once a date has been set and the on-site evaluation team members have been approved by the ETL, the program coordinator must contact the on-site evaluation team members to make arrangements for the evaluation day(s).

5. On-site evaluation

Initial certification requires 2 consecutive days, while students are in class, for the on-site evaluation of all the Standards. However, if more than one program is applying for certification (general automotive and a CNG/LPG program, for example), additional team members and additional days may be required to complete the on-site evaluation. The need for additional team members and/or days will be determined by the NATEF office.

Recertification requires 1-day on-site evaluation, while students are in class, and Standards 6-9 are reviewed by the on-site evaluation team. However, if the Advisory Committee average on Standards 1-5 or Standard 10 was less than 4, these Standards must be reviewed by the on-site evaluation team. The NATEF office will determine whether an additional day or additional team members will be required to complete the evaluation.

6. ETL reports results to NATEF

The ETL will submit all on-site evaluation materials and a final report to NATEF with a recommendation for or against program certification.

7. Program certification

The national office will review the final report and all additional evaluation materials to determine whether the program meets the requirements for certification and will make their recommendation to the ASE Board. The ASE President, however, will approve certification as sanctioned by the Board of Directors.

Programs that do not earn certification will be given a written report specifying improvements that must be made to qualify for certification. The decision at the national level will be final unless appealed to the ASE Board of Directors.

The program administrator and the state Trade & Industrial Supervisor will be notified of all decisions regarding the certification status of all programs applying for ASE certification.

8. Display and reporting of certification materials

A wall plaque identifying the certified areas will be forwarded from the national office to the program administrator. Schools must accurately report areas of ASE certification.

9. Certified CNG/LPG Technician Training List

The NATEF office maintains a current listing of all ASE certified programs. The list is made available upon request.

10. Compliance report

A program will be certified for five years. A compliance report is required after 2½ years. The compliance report will be used to verify that a program is maintaining its standards. NATEF will notify the program administrator of the compliance date and will send the appropriate compliance review forms at that time. The program administrator must complete the forms and return them to the NATEF office.

11. Recertification

The NATEF office will contact the program coordinator six (6) months prior to the certification expiration date. The program must formally request recertification materials and follow the process outlined above.

On-site Evaluation Cost Sheet
Effective April 1, 1995 *

CNG/LPG

	CERTIFICATION	RECERTIFICATION
Certification Manuals	$60.00	$50.00
On-site Evaluation Team Manuals (minimum of 3 sets for initial cert. and 3 sets for recert. @ $40 each.)	$120.00	$120.00
Honorarium for Evaluation Team Leader (ETL) @ $175/day	$350.00	$175.00
Estimated mileage, hotel and meal expenses for the ETL	$150.00	$100.00
ESTIMATED TOTAL COSTS	$680.00	$445.00

NOTE: It is anticipated that team members recruited from local independent repair facilities and dealerships will serve without charge to the institution.

* Cost of certification/recertification subject to change. Contact the NATEF office for current information.

CNG/LPG PROGRAM STANDARDS

STANDARD 1 - PURPOSE

THE CNG/LPG TECHNICIAN TRAINING PROGRAM SHOULD HAVE CLEARLY STATED PROGRAM GOALS, RELATED TO THE NEEDS OF THE STUDENTS AND EMPLOYERS SERVED.

Standard 1.1 - Employment Potential

The employment potential for CNG/LPG technicians, trained to the level for the specialty or general areas outlined in the program goals, should exist in the geographic area served by the program. (Geographic area served includes regions of recruitment and placement of students.)

Standard 1.2 - Program Description/Goals

The written description/goals of the program should be shared with potential students and must include admission requirements, employment potential, area(s) of specialty training offered, and the cost of all tuition and fees. Technical qualifications of the faculty should also be included.

STANDARD 2 - ADMINISTRATION

PROGRAM ADMINISTRATION SHOULD ENSURE THAT INSTRUCTIONAL ACTIVITIES SUPPORT AND PROMOTE THE GOALS OF THE PROGRAM.

Standard 2.1 - Student Competency Certification

The certificate or diploma a student receives upon program completion should clearly specify the area(s) of demonstrated competency.

Standard 2.2 - Chain of Command

An organizational chart should be used to indicate the responsibilities for instruction, administration, and support services.

Standard 2.3 - Administrative Support

Positive administrative support from institutional and local governing bodies should be demonstrated. Indicators of administrative support would include: support for staff in-service training; provision of appropriate facilities; up-to-date tools, equipment, and training support materials.

Standard 2.4 - Written Policies

Written policies should be adopted by the administration and policy board for use in decision-making situations and to provide guidance in achieving the program goals. Policies regarding safety, liability, and lab/shop operation should be written and prominently displayed as well as provided to all students and instructors.

Standard 2.5 - Advisory Committee

An Advisory Committee must convene at least two times a year and be utilized to provide counsel, assistance, and information from the community served by the training program. This Committee should be broadly based and include former students, employed technicians, employers, and representatives for consumer's interests.

Standard 2.6 - Public/Community Relations

An organized plan should be used to provide the community at large information regarding the training program, its graduates, its plans, and any services provided to the community.

Standard 2.7 - Live Work

A systematic method of collecting, documenting, and disbursing live work repair receipts should be used. Instructional staff should not be required to collect payment for live work repairs.

STANDARD 3 - LEARNING RESOURCES

SUPPORT MATERIAL, CONSISTENT WITH BOTH PROGRAM GOALS AND PERFORMANCE OBJECTIVES, SHOULD BE AVAILABLE TO STAFF AND STUDENTS.

Standard 3.1 - Service Information

Service information with current manufacturer's service procedures and specification data for vehicles manufactured within the last ten (10) years should be available. This information should be accessible to students while working in the lab/shop area.

Standard 3.2 - Multimedia

Appropriate up-to-date multimedia materials such as video equipment, transparencies, etc. should be readily available and utilized in the training process.

Standard 3.3 - Instructional Development Services

The service of professional instructional development personnel should be used when available. At a minimum, equipment and supplies should be available for duplication or copying printed materials and transparencies. Instructional development personnel should conduct in-service and/or training in curriculum and media development.

Standard 3.4 - Periodicals

Current general and technical automobile, CNG, and LPG magazines and newspapers should be available for student and instructor use.

Standard 3.5 - Student Materials

Necessary instructional texts or pertinent material should be available for each student to satisfy the objectives of the mode of instruction used. Basic textbooks should have copyright dates that are not over six (6) years old; specialized textbooks should have copyright dates that are not over six (6) years old.

STANDARD 4 - FINANCES

FUNDING SHOULD BE PROVIDED TO MEET THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

Standard 4.1 - Program Training Cost

The enrollment in the program or program area should be sufficient to keep the per-student training costs to a realistic figure.

Standard 4.2 - Budget

An adequate annual budget should be developed, allocated, and used for the operation of the program.

Standard 4.3 - Budget Preparation

The budget should be prepared by the institutional administration in conjunction with the program faculty.

Standard 4.4 - Status Reports

Budget status reports should be made available to program staff, at least quarterly.

STANDARD 5 - STUDENT SERVICES

SYSTEMATIC PRE-ADMISSION TESTING, INTERVIEWS, COUNSELING SERVICES, PLACEMENT, AND FOLLOW-UP PROCEDURES SHOULD BE USED.

Standard 5.1 - Pretesting

A formal pretesting program should be used to assess a student's abilities in reading, mathematics, and mechanical aptitude to evaluate and assure the student a reasonable probability of success as a CNG/LPG technician. Testing procedures and how the tests results will be used (e.g., placement, assessment of student's developmental needs, etc.) should be stated in program explanatory material.

Standard 5.2 - Pre-admission Interviews

Prior to program admission, a student should be interviewed and approved for admission.

Standard 5.3 - Student Records

Permanent records of all students, former and current, should be available, preferably in one central location, and kept confidential.

Standard 5.4 - Placement

A systematic student placement system should be used to assist program graduates to obtain employment in the automotive/CNG/LPG industry.

Standard 5.5 - Follow-up

A follow-up system should be used to determine students' employment location and for feedback regarding the efficiency, effectiveness, and appropriateness of training. The follow-up procedure should be designed to assure feedback regarding needed additions or deletions to the training curriculum, program, and tools and equipment. Follow-up of graduates employed outside of the CNG/LPG industry should indicate reasons for non-CNG/LPG employment. When applicable, this information should be used to modify the training quality and/or content.

Standard 5.6 - Legal Requirements

The training program should meet all applicable local, state, and federal requirements.

STANDARD 6 - INSTRUCTION

INSTRUCTION MUST BE SYSTEMATIC AND REFLECT PROGRAM GOALS. A TASK LIST AND SPECIFIC PERFORMANCE OBJECTIVES WITH CRITERION REFERENCED MEASURES MUST BE USED.

Standard 6.1 - Program Plan

The training plan should progress in logical steps, provide for alternate sequences, where applicable, and be made available to each student.

Standard 6.2 - Student Training Plan

A training plan for each student should be used, indicating the student's training goal(s) and specific steps needed to meet that goal. Students should be given a copy of their training plan.

Standard 6.3 - Preparation Time

Adequate time should be provided for teacher preparation and program development.

Standard 6.4 - Teaching Load

The instructor/student ratio and class contact hours should allow time for interaction on a one-to-one basis.

Standard 6.5 - Curriculum

All tasks have been given a priority rating. Ninety-five percent (95%) of the tasks designated as Priority 1 (P-1) must be taught in the curriculum. Eighty percent (80%) of the

tasks designated as Priority 2 (P-2) must be taught in the curriculum. Fifty percent (50%) of the tasks designated as Priority 3 (P-3) must be taught in the curriculum. Additional tasks may be included to meet the needs of local employers. All additional tasks should be approved by the Advisory Committee.

Instruction on the legal aspects and responsibilities of the CNG/LPG technician in areas such as Environmental Protection Agency regulations, safety regulations, OSHA regulations, and other appropriate requirements should be included in the curriculum. Instruction and practice in filling out work order forms, ordering parts, and basic record keeping should be a part of the training program.

Tools and equipment must be available to perform the tasks in each of the areas for which certification is requested.

Standard 6.6 - Student Progress

A record of each student's progress should be maintained through the use of a progress chart or other recording device. The record should indicate tasks required for mastery in the area and those tasks the student has mastered.

Standard 6.7 - Performance Standards

All instruction should be performance based, with an acceptable performance standard stated for each task. These standards should be shared with students and potential employers. Students should demonstrate "hands-on competency" or "mastery" of a task before the instructor verifies a student's performance.

Standard 6.8 - Safety Standards

Safety instruction should be given prior to lab/shop work and be an integral part of the training program. A safety test should be included in the training program. Students and instructors should comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals while in the lab/shop area.

Standard 6.9 - Personal Characteristics

All training activities and instructional material should emphasize the importance of maintaining high personal standards.

Standard 6.10 - Work Habits/Ethics

The training program should be organized in such a manner that work habits and ethical practices required on the job are an integral part of the instruction.

Standard 6.11 - Provision for Individual Differences

The training program should be structured in such a manner that students with different levels of cognitive and psychomotor skills can be accommodated.

Standard 6.12 - Related Instruction

Instruction in related mathematics, communication, and interpersonal relations should be provided and coordinated with ongoing instruction in the training program. This instruction should be provided by a qualified instructor.

Standard 6.13 - Testing

Both written and performance based tests should be used to validate student competency. Students should be encouraged to take certification tests that are publicly recognized indicators of capabilities.

Standard 6.14 - Evaluation of Instruction

Instructional procedures should be evaluated in a systematic manner. This evaluation should be through regular reviews by students and the administration. Self-evaluation of instruction should also be utilized on a systematic and regular basis. This system should include input from former students and the Advisory Committee members. Instructional procedures should show a responsiveness to the feedback from these evaluations.

Standard 6.15 - Live Work

Live work should be scheduled to benefit the student and supplement ongoing instruction on items specified in the NATEF task list. A student should have had instruction and practice on a specific repair task before live work requiring that task is assigned. Donated vehicles by the manufacturers or other sources, customer-owned vehicles, and other training vehicles may be used as the primary source of live work. CNG/LPG training program student-owned vehicles, school buses, and other vehicles owned and operated by the governing body of the school should not be the primary source of live work vehicles. All vehicles in the lab/shop should have a completed industry-type work order attached to or on the vehicle.

Standard 6.16 - Articulation

Agreements between programs with equivalent competencies should be used to eliminate unnecessary duplication of instruction.

STANDARD 7 - EQUIPMENT

EQUIPMENT AND TOOLS USED IN THE CNG/LPG TECHNICIAN TRAINING PROGRAM MUST BE OF THE TYPE AND QUALITY FOUND IN THE REPAIR INDUSTRY AND MUST ALSO BE THE TYPE NEEDED TO PROVIDE TRAINING TO MEET THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

Standard 7.1 - Safety

Equipment and tools used in the training program must have all shields, guards, and other safety devices in place, operable, and used.

Standard 7.2 - Quantity and Quality

The tools and equipment used in the training program should reflect the program goals and performance objectives. Sufficient tools and equipment should be available for the training offered. The tools and equipment should meet industry quality standards.

Standard 7.3 - Consumable Supplies

Sufficient consumable supplies should be readily available to assure continuous instruction.

Standard 7.4 - Maintenance

A preventive maintenance schedule should be used to minimize equipment down-time.

Standard 7.5 - Replacement

A systematic schedule for replacement should be used to maintain up-to-date tools and equipment at industry and safety standards. Student follow-up and Advisory Committee input should be used in this system.

Standard 7.6 - Inventory

An inventory system should be used to account for tools, equipment, parts, and supplies.

Standard 7.7 - Parts Purchasing

A systematic parts purchasing system, from work order to parts specialist to jobber, should be used. Task performance should not be unreasonably delayed due to lack of replacement parts.

Standard 7.8 - Hand Tools

Each student should have a basic hand tool set comparable to tools required for employment. The students should be encouraged to purchase a hand tool set during the period of instruction, appropriate to the CNG/LPG specialty area(s) in which they are receiving training.

STANDARD 8 - FACILITIES

THE PHYSICAL FACILITIES MUST BE ADEQUATE TO PERMIT ACHIEVEMENT OF THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

Standard 8.1 - Training Stations

Training stations (bench and live work) should be available in the type and number required for the performance of tasks outlined in the program goals and performance objectives.

Standard 8.2 - Safety

The facilities should meet all applicable safety standards and an emergency plan should be in place and posted in all classrooms and lab/shop areas.

Standard 8.3 - Maintenance

A regular facilities maintenance program should be used to ensure facilities are suitable when required for instruction.

Standard 8.4 - Housekeeping

The classroom(s), lab/shop, and support area(s) should be kept clean and orderly.

Standard 8.5 - Office Space

An area separate from the lab/shop should be available and convenient for use as an office by the instructor(s).

Standard 8.6 - Instructional Area

A classroom convenient to, but separate from, the lab/shop area should be available for instruction and other non-lab/shop activities.

Standard 8.7 - Storage

Storage areas for tools, parts, supplies, and vehicles should be sufficient to support the activities outlined in the program goals and performance objectives. Security should be provided to prevent pilferage and vandalism.

Standard 8.8 - Support Facilities

Restrooms, clean-up areas, and lockers should be provided for both male and female students and be convenient to the instructional area.

Standard 8.9 - Ventilation

An adequate exhaust fume removal system should be in place and operational. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning.

Standard 8.10 - First Aid

A first aid kit should be in place and comply with local regulations.

Standard 8.11 - Facility Evaluation

The Advisory Committee should conduct an annual evaluation of the facilities to assure adequacy to meet program goals.

STANDARD 9 - INSTRUCTIONAL STAFF

THE INSTRUCTIONAL STAFF MUST HAVE TECHNICAL COMPETENCY AND MEET ALL STATE AND LOCAL REQUIREMENTS FOR CERTIFICATION.

Standard 9.1 - Technical Competency

The instructor(s) must hold current ASE certification(s) in the specialty area(s) they teach. (Currently there is no LPG certification test. 10/1995)

Standard 9.2 - Instructional Competency/Certification

Instructors should meet all state certifying requirements.

Standard 9.3 - Technical Updating

Faculty members should be provided technical materials required to maintain their competency. An opportunity should be provided for instructors to return to industry on a regular basis for in-service and skill upgrading.

Standard 9.4 - First Aid

The program should have a written policy, approved by the administrator of the school, on First Aid procedures. Emergency procedures should be posted.

Standard 9.5 - Substitutes

A systematic method of obtaining "substitute" instructors should be used to assure instructional continuity. An orientation session for substitutes should be held on a regular basis. The substitute should be a competent automobile and/or CNG/LPG instructor.

STANDARD 10 - COOPERATIVE AGREEMENTS

WRITTEN POLICIES AND PROCEDURES SHOULD BE USED FOR COOPERATIVE AND APPRENTICESHIP TRAINING PROGRAMS.

Standard 10.1 - Standards

Student performance standards should be developed and coordinated by the supervising instructor.

Standard 10.2 - Agreements

All agreements should be written and legally binding.

Standard 10.3 - Supervision

A supervising CNG/LPG instructor should be assigned responsibility, authority, and time to coordinate and monitor cooperative/apprenticeship CNG/LPG programs.

TASK LIST AND ASSUMPTIONS

The NATEF CNG and LPG task list was developed in 1995 with funding from a cooperative agreement with the U.S. Department of Energy. Between June 20 and August 10, 1995, a national committee was assembled and conducted four, three-day workshops in Herndon, Virginia to identify the standards used in the Light/Medium-Duty CNG and LPG certification programs. The committee consisted of individuals representing the major automobile manufacturers, conversion equipment manufacturers, fuel suppliers, CNG and LPG conversion companies, technicians, and educators. All participants have had significant experience with CNG, LPG, or both.

The committee reviewed NATEF program standards, task list, tools and equipment list, program hours, instructor qualifications, and Evaluation Team Leader (ETL) qualifications. The committee also had the most current NATEF automobile task list, the National Institute for Automotive Service Excellence (ASE) Light Vehicle-Compressed Natural Gas task list (F-1) and the American Society for Advanced Fuels Technology (ASAFT) task list for reference purposes.

In defining the CNG and LPG task lists for secondary and post-secondary CNG/LPG programs, the committee elected to allow for as much overlap as practical with the Automobile Certification Program. Although an allowance was made for automobile and CNG/LPG programs to overlap, the CNG/LPG Program Certification is a separate, stand alone, certification.

All the tasks are assigned a priority number: P-1, P-2, or P-3. Please refer to the Task List Information in the Policies section for additional information on the requirements for instruction on tasks.

Theory instruction and hands-on performance of all the basic tasks will provide initial training for employment in the CNG/LPG service field. Competency in the tasks will indicate to employers that the graduate is skilled in that area.

GENERAL ASSUMPTIONS

1. It is assumed that:

* in all areas, appropriate theory, safety, and support instruction will be required for performing each task;
* the instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks;
* the student has received the necessary training to locate and use current reference and training materials from accepted industry publications.

2. It is assumed that:

* all diagnostic and repair tasks described in this document are to be accomplished in accordance with manufacturer's recommended procedures as published.

3. It is assumed that:

* individual training programs being evaluated for certification should have written and detailed performance standards for each task taught in the curriculum;
* learning progress of students will be monitored and evaluated against these performance standards;
* a system is in place which informs all students of their individual progress through all phases of the training program.

4. It is assumed that:

* individual courses of study will differ across CNG/LPG technician training programs;
* development of appropriate learning delivery systems and tests which monitor student progress will be the responsibility of the individual training program.

5. It is assumed that:

* all students will receive instruction in the storage, handling, and use of Hazardous Materials as required in Hazard Communication Title 29 Code of Federal Regulation Part 1910.1200, "Right to Know Law".

STATUS OF THE CNG/LPG INDUSTRY

The CNG/LPG conversion industry is currently in a period of transition. In the past, it had been common practice for the conversions to be configured on site by a technician. Although this is still being done by some conversion companies, the industry is growing more concerned about the issues of emissions compliance and the liability implication as it relates to their modifications of the base vehicle. Therefore, many conversions are performed using kits/systems that have been configured and certified for a specific vehicle or engine family.

Although kits are now being configured for specific engine families and chassis types, many kit configurations do not specify the exact location for many components such as tanks and regulators. Currently, kit configurations primarily are concerned with how the CNG or LPG system will interact with the base vehicle's engine performance and emissions compliance.

CNG/LPG PROGRAM ASSUMPTIONS.

The following assumptions were developed by the workshop members to define the boundaries by which the tasks statements were to be written.

1. It is assumed that:

   * as part of the standards by which training programs are measured, students will not be expected to make engineering judgments (Such judgments can not be satisfactorily validated in the field or by an AFV technician.);
   * where engineering judgments must be made on equipment installation locations, it is assumed that such decisions will be made by the management and/or engineering staff of the conversion company.

2. It is assumed that:

   * students will be expected to use manufacturer's specifications and procedures when such information is provided;
   * students will be expected to use/reference all applicable industry accepted standards where the directions or specifications are not provided by the manufacturer;
   * students will be able to use/reference all current applicable industry and government regulations/accepted practices and have knowledge of these agencies.

3. It is assumed that:

   * the CNG/LPG training program will include instruction on: fuel characteristics, differences between gasoline/diesel and alternative fuels, safety implications of these characteristics/differences, appropriate technical terminology, and potential environmental and economic costs/benefits.

DEFINITIONS

ADD - To increase fluid or pressure to the correct level or amount.

ADJUST - To bring components to specified operational settings.

AIR TEST - To use air pressure to determine proper action of components.

ALIGN - To bring to precise alignment or relative position of components.

ANALYZE - To examine the relationship of components of an operation.

ASSEMBLE (REASSEMBLE) - To fit together the components of a device.

BALANCE - To establish correct linear, rotational or weight relationship.

BLEED - To allow air/fluids to enter or exit a closed system.

CHARGE - To bring to "full" state; e.g., battery or air conditioning system.

CHECK - To verify condition by performing an operational or comparative examination.

CLEAN - To rid component of extraneous matter for the purpose of reconditioning, repairing, measuring or reassembling.

DETERMINE - To establish the procedure to be used to effect the necessary repair.

DIAGNOSE - To locate the cause or nature of a problem by using the specified procedure.

DISASSEMBLE - To separate a component's parts as a preparation for cleaning, inspection or service.

DISCHARGE - To empty a storage device or system.

DRAIN - To use gravity to empty a container.

EVACUATE - To remove air, fluid or vapor from a closed system by use of a vacuum pump.

FILL (REFILL) - To bring fluid level to specified point or volume.

FIND - To locate a particular problem, e.g., shorts, grounds or opens in an electrical circuit.

FLUSH - To use a fluid to clean an internal system.

HONE - To restore or resize or bore by using rotating cutting stones.

IDENTIFY - To establish the identity of a vehicle or component prior to service; to determine the nature or degree of a problem.

INSPECT - (SEE CHECK)

INSTALL (REINSTALL) - To place a component in its proper position in a system.

JUMP START - To use an auxiliary power supply, i.e., battery, battery charger, etc. to assist a vehicle's battery to crank an engine.

LEAK TEST - To locate the source of leaks in a component or system.

LISTEN - To use audible clues in the diagnostic process; to hear the customer's description of a particular problem.

LUBRICATE - To employ the correct procedures and materials in performing the prescribed lubrication service.

MEASURE - To compare existing dimensions to specified dimensions by the use of calibrated instruments and gauges.

MOUNT - To attach or place tool or component in proper position.

PRESSURE TEST - To use air or fluid pressure to determine the condition or operation of a component or system.

PERFORM - To accomplish a procedure in accordance with established methods.

PURGE - To eliminate an undesired air or fluid from a closed system.

READY - To prepare a system or component for service, installation or operation.

REASSEMBLE - (SEE ASSEMBLE)

REFILL - (SEE FILL)

REINSTALL - (SEE INSTALL)

REMOVE - To disconnect and separate a component from a system.

REPAIR - To restore a malfunctioning component or system to operating condition.

REPLACE - To exchange an unserviceable component with a new or rebuilt component; to reinstall a component.

RESET (SET) - To adjust a variable component to a given, usually initial, specification.

SELECT - To choose the correct part or setting during assembly or adjustment.

SERVICE - To perform a specified procedure when called for in the owner's or service manual.

TEST - To verify condition through the use of meters, gauges or instruments.

TRIM - (SEE ADJUST)

TORQUE - To tighten a fastener to specified degree or tightness (in a given order or pattern if multiple fasteners are involved on a single component).

VACUUM TEST - To determine the integrity and operation of a vacuum operated component and/or system.

VERIFY - To establish that a problem exists after hearing the customer's complaint and performing a preliminary diagnosis.

NATEF TASK LIST

CNG/LPG ELECTRICAL/ELECTRONIC SYSTEMS

For every task in Electrical/Electronic Systems, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

Note: The CNG/LPG Electrical/Electronic area is basically a sub-set of the Automobile Electrical/Electronic area. Not all of the Automobile tasks are required in the CNG or LPG task list. Task areas that do not apply to the CNG/LPG program are indicated with an "N/A" in the priority column. Tasks that have been modified significantly in content or priority rating have been marked with "*" under the priority rating.

I. ELECTRICAL/ELECTRONIC SYSTEMS

A. General Electrical System Diagnosis

1.	Use wiring diagrams during diagnosis of electrical circuit problems.	P-1
2.	Check electrical circuits with a test light; determine needed repairs.	P-2
3.	Check voltages and voltage drops in electrical/electronic circuits using a digital multimeter (DMM); determine needed repairs.	P-1
4.	Check current flow in electrical/electronic circuits and components using an ammeter; determine needed repairs.	P-2
5.	Check electrical circuits using jumper wires; determine needed repairs.	P-2
6.	Find shorts, grounds, opens, and high resistance problems in electrical/electronic circuits; determine needed repairs.	P-1
7.	Measure and diagnose the cause(s) of abnormal key-off battery drain; determine needed repairs.	P-1
8.	Inspect and test fusible links, circuit breakers, and fuses; replace as needed.	P-1
9.	Inspect and test switches, connectors, and wires of electrical/electronic circuits; repair or replace as needed.	P-1

I. ELECTRICAL/ELECTRONIC SYSTEMS

B. Battery Diagnosis and Service

1.	Perform battery state-of-charge test; determine needed service.	P-2
2.	Perform battery capacity (load, high-rate discharge) test; determine needed service.	P-2
3.	Maintain or restore electronic memory functions.	P-2
4.	Inspect, clean, fill or replace battery.	P-2
5.	Perform slow/fast battery charge.	P-2
6.	Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed.	P-2
7.	Start a vehicle using jumper cables and a battery or auxiliary power supply.	P-2

I. ELECTRICAL/ELECTRONIC SYSTEMS

C. Starting System Diagnosis and Repair

1.	Perform starter current draw and circuit voltage drop test; determine needed repairs.	P-1
2.	Inspect and test starter relays and solenoids; replace as needed.	P-2
3.	Remove and replace/reinstall starter.	P-2
4.	Perform starter free-running (bench) tests; determine needed repairs.	P-2

I. ELECTRICAL/ELECTRONIC SYSTEMS

D. Charging System Diagnosis and Repair

1.	Diagnose charging system problems that cause an undercharge, a no-charge or an overcharge condition.	P-2
2.	Inspect and adjust alternator drive belts; replace as needed.	P-2

3.	Inspect and test voltage regulator; replace as needed.	P-2
4.	Remove, inspect, and replace/reinstall alternator.	P-2
5.	Disassemble, clean, inspect, and test alternator components; replace as needed.	P-2

I. ELECTRICAL/ELECTRONIC SYSTEMS

E. Lighting Systems Diagnosis and Repair N/A

I. ELECTRICAL/ELECTRONIC SYSTEMS

F. Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair

1.	Diagnose the cause of intermittent, high, low or no gauge readings.	P-2
2.	Test gauge circuit voltage regulators (limiters); replace as needed.	P-3
3.	Inspect and test gauges and gauge sending units; replace as needed.	P-2
4.	Inspect and test connectors, wires, and printed circuit boards of gauge circuits; repair or replace as needed.	P-3
5.	Diagnose the cause of constant, intermittent or no warning light and driver information system operation.	P-2
6.	Diagnose the cause(s) of intermittent, high, low or no readings on electronic digital instrument clusters.	P-3
7.	Inspect and test sensors, sending units, connectors, and wires of electronic digital instrument circuits; repair or replace as needed.	P-3

I. ELECTRICAL/ELECTRONIC SYSTEMS

G. Horn and Wiper/Washer Diagnosis and Repair N/A

I. ELECTRICAL/ELECTRONIC SYSTEMS

H. Accessories Diagnosis and Repair N/A

ENGINE PERFORMANCE

For every task in Engine Performance, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

Note: The CNG/LPG Engine Performance area is basically a sub-set of the Automobile Engine Performance area. Not all of the Automobile tasks are required in the CNG or LPG task list. Task areas that do not apply to the CNG/LPG program are indicated with an "N/A" in the priority column. Tasks that have been modified significantly in content or priority rating have been marked with "*" under the priority rating.

II. ENGINE PERFORMANCE

A. General Engine Diagnosis

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed repairs.	P-2
3.	Diagnose the cause of unusual engine noise or vibration problems; determine needed repairs.	P-2
4.	Diagnose the cause of unusual exhaust color, odor, and sound; determine needed action.	P-2
5.	Perform engine absolute (vacuum/boost) manifold pressure tests; determine needed repairs.	P-2
6.	Perform cylinder power balance test; determine needed action.	P-2
7.	Perform cylinder compression test; determine needed action.	P-2
8.	Perform cylinder leakage test; determine needed action.	P-2
9.	Diagnose engine mechanical, electrical, electronic, fuel, and ignition problems with an oscilloscope and engine diagnostic equipment; determine needed action.	P-2

10.	Prepare 4 or 5 gas analyzer, inspect and prepare vehicle for test and obtain exhaust readings; interpret readings and determine needed action.	P-1

II. ENGINE PERFORMANCE

B. Computerized Engine Controls Diagnosis and Repair

1.	Diagnose the causes of emissions problems resulting from failure of computerized engine controls.	P-2
2.	Perform analytic/diagnostic procedures on vehicles with on-board diagnostic computer systems; determine needed action.	P-2
3.	Inspect and test sensors, controls, and actuator components and circuits of computerized engine control systems; adjust or replace as needed.	P-2
4.	Obtain and interpret digital multimeter (DMM) readings.	P-1
5.	Read and interpret technical information.	P-1
6.	Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels and calibration decals).	P-1
7.	Inspect and test power and ground circuits and connections; service or replace as needed.	P-2
8.	Practice recommended precautions when handling static sensitive devices.	P-2
9.	Inspect, test, service, disassemble and assemble wire harness connectors and wire taps, using manufacturer's specifications.	P-2

II. ENGINE PERFORMANCE

C. Ignition System Diagnosis and Repair

1.	Diagnose no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions problems on vehicles with electronic ignition systems; determine needed repairs.	P-2
2.	Inspect and test ignition primary circuit wiring and components; repair or replace as needed.	P-2

3.	Inspect and test distributor; service as needed.	P-2
4.	Inspect and test ignition system secondary circuit wiring and components; replace as needed.	P-2
5.	Inspect and test ignition coil(s); replace as needed.	P-2
6.	Check and adjust (where applicable) ignition system timing and timing advance/retard.	P-2
7.	Inspect and test ignition wiring harness and connectors; replace as needed.	P-2
8.	Inspect and test ignition system pick-up sensor or triggering devices; replace as needed.	P-2
9.	Inspect and test ignition control module; replace as needed.	P-2

II. ENGINE PERFORMANCE

D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

1.	Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with carburetor-type fuel systems; determine needed action.	P-3 *
2.	Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems; determine needed action.	P-3 *
3.	Inspect and replace fuel tank, fuel cap, fuel lines, fittings, and hoses.	P-2
4.	Check fuel for contaminants and quality.	P-3
5.	Inspect and test mechanical and electrical fuel pumps and pump control systems; replace as needed.	P-2
6.	Replace fuel filters.	P-2

7.	Inspect and test fuel pressure regulation system and components of injection type fuel systems; adjust or replace as needed.	P-2
8.	Inspect and test cold enrichment system components; adjust or replace as needed.	P-2
9.	Remove, clean, and reinstall throttle body; adjust related linkages.	P-2
10.	Inspect and test fuel injectors; clean or replace as needed.	P-2
11.	Inspect throttle body mounting plates, air induction and filtration system, intake manifold, and gaskets; clean or replace as needed.	P-2
12.	Check/adjust idle speed and fuel mixture where applicable.	P-2
13.	Remove, inspect, and test vacuum and electrical components and connections of fuel system; repair or replace as needed.	P-2
14.	Inspect exhaust manifold, exhaust pipes, mufflers, resonators, tail pipes, and heat shields; repair or replace as needed.	P-2

II. ENGINE PERFORMANCE

E. Emissions Control Systems Diagnosis and Repair

1. Positive Crankcase Ventilation

1.	Diagnose the cause(s) of emissions problems resulting from failure of the positive crankcase ventilation system.	P-2
2.	Inspect and test positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; service or replace as needed.	P-2

2. Spark Timing Controls

1.	Diagnose the cause(s) of emissions problems resulting from failure of the spark timing control system.	P-2
2.	Inspect and test circuits of spark timing control systems; replace as needed.	P-2

3. Idle and Deceleration Speed Controls

1.	Diagnose the cause(s) of emissions problems resulting from failure of the idle and deceleration speed control system.	P-2
2.	Inspect and test wiring, hoses, and components of idle speed control systems; adjust or replace as needed.	P-2
3.	Inspect and test electrical components, circuits, vacuum components, and hoses of deceleration controls; adjust or replace as needed.	P-2

4. Exhaust Gas Recirculation

1.	Diagnose the cause(s) of emissions problems caused by failure of the exhaust gas recirculation (EGR) system.	P-2
2.	Inspect and test valve, valve manifold, and exhaust passages of exhaust gas recirculation (EGR) systems; service or replace as needed.	P-2
3.	Inspect and test vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) systems; service or replace as needed.	P-2
4.	Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; repair or replace as needed.	P-2

5. Exhaust Gas Treatment

1.	Diagnose the cause(s) of emissions problems resulting from failure of the air injection or catalytic converter systems.	P-2
2.	Inspect and test mechanical components of air injection systems; service or replace as needed.	P-2
3.	Inspect and test electrical/electronically operated components and circuits of air injection systems; replace as needed.	P-2
4.	Inspect and test components of catalytic converter systems; replace as needed.	P-2

6. Intake Air Temperature Controls

1.	Diagnose the cause(s) of emissions problems resulting from failure of the intake air temperature control systems.	P-2
2.	Inspect and test components of inlet air temperature control systems; replace as needed.	P-2

7. Early Fuel Evaporation (Intake Manifold Temperature) Controls

1.	Diagnose the cause(s) of emissions problems resulting from failure of early fuel evaporation control systems.	P-2
2.	Inspect and test components of early fuel evaporation control systems; service or replace as needed.	P-2

8. Evaporative Emissions Controls

1.	Diagnose the cause(s) of emissions problems resulting from failure of evaporative emissions control system.	P-2
2.	Inspect and test components and hoses of evaporative emissions control systems; replace as needed.	P-2

II. ENGINE PERFORMANCE

F. Engine Related Service

1.	Adjust valves on engines with mechanical or hydraulic lifters.	P-2
2.	Verify correct camshaft timing; determine needed action.	P-2
3.	Verify engine operating temperature; determine needed action.	P-2
4.	Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; service or replace as needed.	P-2
5.	Inspect and test thermostat, by-pass, and housing; replace as needed.	P-2
6.	Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, and fan control devices; service or replace as needed.	P-2

LPG DIAGNOSIS AND REPAIR

For every task in LPG Diagnosis and Repair, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

III. LPG DIAGNOSIS AND REPAIR

A. Diagnose & Repair Supplemental Systems

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Analyze symptoms and perform diagnostic procedures on vehicles with supplemental on-board diagnostic computer support systems.	P-2
3.	Diagnose and repair no starting, hard starting, engine misfire, poor driveability, power loss, poor mileage, and emissions problems on vehicle's OEM and supplemental sensors (e.g., manifold skin temperature, intake air temperature, etc.).	P-2
4.	Diagnose and repair no-starting, hard starting, engine misfire, poor driveability, power loss, poor mileage, and emissions problems on vehicles with supplemental computer support systems (e.g., timing modification devices, ignition interrupt).	P-2
5.	Diagnose and repair intermittent or complete failure of electric, electronic or mechanical devices (e.g., hour meters, fuel level indicators, fuel selection devices).	P-2

B. LPG Fuel Storage and Delivery

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Check all fuel system components to include fuel lock-off, valves, solenoids, manual shutoff, connections, fittings, hoses and tubing for leaks, wear, installation and proper operation; repair or replace as needed.	P-1
3.	Diagnose the cause of abnormal fuel flow through fuel carrying component.	P-2

4. Diagnose the cause of fuel odor or fuel loss by inspecting or testing the fuel supply system components such as valves, fuel supply container, pressure relief device (PRD), tubing and hoses; repair or replace as needed. P-2

5. Diagnose the cause of inaccurate fuel level indicator reading; service, adjust, repair or replace as needed. P-3

C. LPG A/F Management

1. Interpret and verify complaint; determine needed repairs. P-2

2. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, and lean or rich mixture problems on vehicles with variable or fixed venturi type fuel systems; determine needed repairs. P-2

3. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, and lean or rich mixture problems on vehicles with fumigation or injection type fuel systems; determine needed repairs. P-2

4. Inspect and test cold enrichment system components; adjust or replace as needed. P-2

5. Inspect and test fuel injectors; service or replace as needed. P-3

6. Inspect and test vacuum and electrical components and connections of fuel system; repair or replace as needed. P-3

7. Perform diagnostic procedures on vehicles with on-board computer/electronic fuel system support. P-2

LPG MAINTENANCE

For every task in LPG Maintenance, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

IV. LPG MAINTENANCE

A. General

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Follow manufacturer's maintenance schedule to ensure fluids and lubricants are at proper levels and serviced with recommended products.	P-2
3.	Identify the process of recertification or replacement of fuel supply container(s) according to most current regulations (e.g., DOT); complete documentation; remove and replace fuel supply container, if required.	P-2
4.	Inspect fuel supply container(s) and brackets as it relates to certification: data plate, working pressures, fuel supply container damage, valves, bolts, torque specifications, and all sealing and venting equipment.	P-1
5.	Inspect air filters and fuel filter; service or replace as needed.	P-2
6.	Inspect and ensure that all required emission control devices are present and functional.	P-1

B. LPG Fuel Storage and Delivery

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Inspect, adjust, and test manual shut-off valve, service valve, check-valves, and solenoid valves; repair or replace as needed.	P-2

3.	Empty fuel supply container according to manufacturer's procedures and all local, state and federal regulations. (Local procedures will vary and extreme care must be exercised.)	P-1
4.	Inspect and test fuel selection system components; repair or replace as needed.	P-2
5.	Select and install flare, NPT, and other fittings using required sealants for LPG according to manufacturer's specifications.	P-1

C. LPG A/F Management

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Check for fuel system problems caused by fuel contamination.	P-3
3.	Check air/fuel system integrity (e.g., fuel leaks, air leaks, components compatibility/application); determine needed repairs.	P-2
4.	Inspect and test fuel pressure regulation system components; adjust, repair or replace as needed.	P-2
5.	Remove, clean, and reinstall throttle assemblies; adjust related linkages as needed.	P-3
6.	Check/adjust idle speed and fuel mixtures according to manufacturer's procedures.	P-2

D. LPG Fuel Storage and Handling

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Perform safe fueling procedures and determine fuel level.	P-1
3.	Identify working pressures and demonstrate an understanding of fuel characteristics as they relate to temperature and fill procedures.	P-1
4.	Empty fuel system using industry practices or manufacturer's procedures and all local, state and federal regulations. (Local procedures will vary and extreme care must be exercised.)	P-1

LPG CONVERSION/INSTALLATION

For every task in LPG Conversion/Installation, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

V. LPG CONVERSION/INSTALLATION

1.	Inspect the vehicle for pre-existing conditions that may adversely affect the performance of the vehicle.	P-2
2.	Document pre-conversion conditions and complete all necessary reports.	P-2
3.	Prepare vehicle for conversion according to manufacturer's directions.	P-3
4.	Install fuel supply container with mounting hardware, valving, shielding, fuel level indicator, and remote fill assembly as needed, using manufacturer's specifications and required local, state and federal regulations.	P-1
5.	Install pressure relief device (PRD) and venting system.	P-1
6.	Select and install flare, NPT, and other fittings using required sealants for LPG according to manufacturer's specifications.	P-1
7.	Install gas tight enclosure around valves and fittings, vent to the outside of vehicle as required.	P-1
8.	Determine routing and protection of fuel line components according to industry standards.	P-1
9.	Prepare tubing using proper techniques for cutting, deburring, cleaning, and bending.	P-1
10.	Install tubing, piping, hose, and valves using appropriate chafing protection, mounting hardware, and protective shields, according to industry safety standards.	P-1

11.	Determine appropriate location and mounting of the converter/regulator; install the converter/regulator using mounting brackets, fuel lock, fittings, starting aids, control valves, cooling lines, and thermostat as required and according to manufacturer's specifications.	P-1
12.	Install fuel injection/carburetion or other fuel control components according to manufacturer's instructions.	P-1
13.	Install electrical/electronic components using OEM or manufacturer's wire connections and wiring diagrams, applying all safety precautions.	P-1
14.	Determine location of electrical components considering safety, serviceability, function, component protection, and esthetics according to manufacturer's specifications (when available).	P-1
15.	Inspect and test each installed component to ensure it is connected and positioned in a safe and effective manner.	P-1
16.	Purge and pressurize fuel system and check for system integrity through its maximum working pressure (leak test).	P-1
17.	Perform system setup procedures according to manufacturer's specifications.	P-2
18.	Fabricate brackets, shields, and braces according to accepted industry standards.	P-2
19.	Complete and affix required safety/information labels.	P-1
20.	Test vehicle for acceptable driveability and operation (on each fuel for dual fuel vehicles).	P-3
21.	Inspect and ensure that all required emissions control devices are present and functional; confirm that the vehicle emissions meet applicable local, state, and federal requirements.	P-1
22.	Perform pre and post conversion emissions evaluation.	P-3

CNG DIAGNOSIS AND REPAIR

For every task in CNG Diagnosis and Repair, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

VI. CNG DIAGNOSIS AND REPAIR

A. Diagnose & Repair Supplemental Systems

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Analyze symptoms and perform diagnostic procedures on vehicles with supplemental on-board diagnostic computer support systems.	P-2
3.	Diagnose and repair no starting, hard starting, engine misfire, poor driveability, power loss, poor mileage, and emissions problems on vehicle's OEM and supplemental sensors (e.g., manifold skin temperature, intake air temperature, natural gas tank temperature).	P-2
4.	Diagnose and repair no-starting, hard starting, engine misfire, poor driveability, power loss, poor mileage, and emissions problems on vehicles with supplemental computer support systems (e.g., timing modification devices, ignition interrupt).	P-2
5.	Diagnose and repair intermittent or complete failure of electric, electronic or mechanical devices (e.g., hour meters, fuel level indicators, fuel selection devices).	P-2

B. Fuel Storage and Delivery

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Check all fuel system components to include fuel lock-off, valves, solenoids, manual shutoff, connections, fittings, hoses, and tubing for leaks, wear, installation and proper operation; repair or replace as needed.	P-1
3.	Diagnose the cause of abnormal fuel flow through fuel carrying component.	P-2

4.	Diagnose the cause of fuel odor or fuel loss by inspecting or testing the fuel supply system components such as valves, fuel supply container, pressure relief device (PRD), tubing and hoses; repair or replace as needed.	P-2
5.	Diagnose the cause of inaccurate fuel level indicator reading; service, adjust, repair or replace as needed.	P-3

C. A/F Management

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, and lean or rich mixture problems on vehicles with variable or fixed venturi type fuel systems; determine needed repairs.	P-2
3.	Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, and lean or rich mixture problems on vehicles with fumigation or injection type fuel systems; determine needed repairs.	P-2
4.	Inspect and test cold enrichment system components; adjust or replace as needed.	P-2
5.	Inspect and test fuel injectors; service or replace as needed.	P-3
6.	Inspect and test vacuum and electrical components and connections of fuel system; repair or replace as needed.	P-3
7.	Perform diagnostic procedures on vehicles with on-board computer/electronic fuel system support.	P-2

CNG MAINTENANCE

For every task in CNG Maintenance, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

VII. CNG MAINTENANCE

A. General

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Follow manufacturer's maintenance schedule to ensure fluids and lubricants are at proper levels and serviced with recommended products.	P-2
3.	Identify the process of recertification or replacement of fuel supply container(s) according to most current regulations (e.g., NGV-2, DOT); complete documentation; remove and replace fuel supply container, if required.	P-2
4.	Inspect fuel supply container(s) and brackets as it relates to certification: data plate, working pressures, fuel supply container damage, valves, bolts, torque specifications, and all sealing and venting equipment.	P-1
5.	Inspect air filters and fuel filter; service or replace as needed.	P-2
6.	Inspect and ensure that all required emission control devices are present and functional.	P-1

B. CNG Fuel Storage and Delivery

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Inspect, adjust, and test manual shut-off valve, service valve, check-valves, and solenoid valves; repair or replace as needed.	P-2

3.	Empty fuel supply container according to manufacturer's procedures and all local, state and federal regulations. (Local procedures will vary and extreme care must be exercised if using actual fuel. Use of inert gas is recommended for this task.)	P-1
4.	Inspect and test fuel selection system components; repair or replace as needed.	P-2
5.	Select and install swage, compression, flare, captive O-ring, NPT, and other fittings using manufacturer's recommended sealants when required.	P-1

C. CNG A/F Management

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Check for fuel system problems caused by fuel contamination.	P-3
3.	Check air/fuel system integrity (e.g., fuel leaks, air leaks, components compatibility/application); determine needed repairs.	P-2
4.	Inspect and test fuel pressure regulation system components; adjust, repair or replace as needed.	P-2
5.	Remove, clean, and reinstall throttle assemblies; adjust related linkages as needed.	P-3
6.	Check/adjust idle speed and fuel mixtures according to manufacturer's procedures.	P-2

D. CNG Fuel Storage and Handling

1.	Interpret and verify complaint; determine needed repairs.	P-2
2.	Perform safe fueling procedures and determine fuel level.	P-1
3.	Identify working pressures and demonstrate an understanding of fuel characteristics as they relate to temperature and fill procedures.	P-1
4.	Empty fuel system using industry practices or manufacturer's procedures and all local, state and federal regulations. (Local procedures will vary and extreme care must be exercised if using actual fuel. Use of inert gas is recommended for this task.)	P-1

CNG CONVERSION/INSTALLATION

For every task in CNG Conversion/Installation, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations.

VIII. CNG CONVERSION/INSTALLATION

1.	Inspect the vehicle for pre-existing conditions that may adversely affect the performance of the vehicle.	P-2
2.	Document pre-conversion conditions and complete all necessary reports.	P-2
3.	Prepare vehicle for conversion according to manufacturer's directions.	P-3
4.	Install fuel supply container with mounting hardware, valving, shielding, fuel level indicator, and remote fill assembly, as needed, using manufacturer's specifications and required local, state and federal regulations.	P-1
5.	Install pressure relief device (PRD) and venting system.	P-1
6.	Select and install swage, compression, flare, captive O-ring, NPT, and other fittings using manufacturer's recommended sealants when required.	P-1
7.	Install gas tight enclosure around valves and fittings, vent to the outside of vehicle as required.	P-1
8.	Determine routing and protection of fuel line components according to industry standards.	P-1
9.	Prepare tubing using proper techniques for cutting, deburring, cleaning, and bending.	P-1

10.	Install tubing, piping, hose, and valves using appropriate chafing protection, mounting hardware, and protective shields, according to industry safety standards.	P-1
11.	Determine appropriate location and mounting of the regulators; install the regulators using mounting brackets, fuel lock, fittings, starting aids, control valves, cooling lines, and thermostat as required and according to manufacturer's specifications.	P-1
12.	Install fuel injection/carburetion or other fuel control components according to manufacturer's instructions.	P-1
13.	Install electrical/electronic components using OEM or manufacturer's wire connections and wiring diagrams, applying all safety precautions.	P-1
14.	Determine location of electrical components considering safety, serviceability, function, component protection, and esthetics according to manufacturer's specifications (when available).	P-1
15.	Inspect and test each installed component to ensure it is connected and positioned in a safe and effective manner.	P-1
16.	Purge and pressurize fuel system and check for system integrity through its maximum working pressure (leak test).	P-1
17.	Perform system setup procedures according to manufacturer's specifications.	P-2
18.	Fabricate brackets, shields, and braces according to accepted industry standards.	P-2
19.	Complete and affix required safety/information labels.	P-1
20.	Test vehicle for acceptable driveability and operation (on each fuel for dual fuel vehicles).	P-3
21.	Inspect and ensure that all required emissions control devices are present and functional; confirm that the vehicle emissions meet applicable local, state, and federal requirements.	P-1
22.	Perform pre and post conversion emissions evaluation.	P-3

CNG/LPG PROGRAM TOOLS & EQUIPMENT

Local employment opportunities and the availability of funds are key factors for determining the program's structure and operation. This section was developed with the understanding that many programs will not teach 100% of the tasks. Therefore, the basic philosophy is this: for the tasks which are taught, the training should be as thorough as possible with the tools and equipment necessary for those tasks.

The basic tools and equipment that must be available to the students for training in any given specialty area are included in this section. Obviously, there are duplications of tools and equipment for some or all of the specialty areas. No specific brand names are identified because they will vary in each local situation.

The student hand tool list covers all areas, and indicate the tools a student will need to be successful in each of the specialty areas. Most employers require that a candidate for employment provide his/her own basic hand tool set in order to be hired as an entry level technician.

A significant overlap exists between the tool/equipment list for general automobile programs and CNG/LPG programs.

HAND TOOLS
CONTAINED IN INDIVIDUAL SETS OR TOOL CRIB
(IN SUFFICIENT QUANTITIES TO PERMIT EFFICIENT INSTRUCTION)

Adjustable Wrench - 6" and 12"
Air Blow Gun (meeting OSHA standards)
Allen Wrench Set - Standard (.050" - 3/8")
Allen Wrench Set - Metric (2mm - 7mm)
Battery Post Cleaner
Battery Terminal Pliers
Battery Terminal Puller
Chisels:
- Cape 5/16"
- Cold 3/8", 3/4"

Claw Type Pickup Tool
Combination Wrenches:
- Standard (1/4" - 1")
- Metric (7mm - 19mm)

Continuity Test Light (12V)
Crowfoot Wrench Set (Metric)
Crowfoot Wrench Set (Standard)
Feeler Gauge (Blade Type):
- .002" - .040"
- .006mm - .070mm

Files:
- Coarse 6" and 12"
- Fine 6" and 12"
- Half Round 12"
- Round 6" and 12"

Flare Nut (tubing) Wrenches:
- Standard (3/8" - 3/4")
- Metric (10mm - 17mm)

Flashlight
Hack Saw
Hammers:
- 16 oz. Ball Peen
- Brass
- Dead Blow Plastic Mallet
- Plastic Tip

Ignition Wrench Set - Standard and Metric
Inspection Mirror
Jumper Wire Set (with various adapters)
Magnetic Pickup Tool

Pliers:
- Combination 6"
- Hose Clamp
- Locking Jaw
- Needle Nose 6"
- Side Cutting
- Slip Joint (Water Pump)

Pry Bars:
- Rolling Head
- Straight

Punches:
- Center
- Brass Drift
- Pin - 1/8", 3/16", 1/4", 5/16"
- Taper - 3/8", 1/2", 5/8"

Safety Glasses

Scraper:
- Carbon 1"
- Gasket 1"

Screwdriver - Blade Type:
- Stubby
- 6", 9", 12"
- Offset

Screwdriver - Phillips:
- Stubby #1, #2
- 6" #1, #2
- 12" #3
- Offset #2

Screwdriver - Posidrive Set: #1, #2, #3, #4

Screw Starter:
- Phillips
- Slotted

Socket Set - 1/4" Drive:
- 1/4" - 1/2" Shallow Depth
- 1/4" - 1/2" Deep
- 6mm - 12mm Shallow Depth
- 6mm - 12mm Deep
- Flex/Universal Type
- 3", 6" Extensions
- Ratchet

Socket Set - 3/8" Drive:
- 5/16" - 3/4" Shallow Depth (6 point)
- 3/8" - 3/4" Deep (6 point)
- 9mm - 19mm Shallow Depth
- 9mm - 19mm Deep
- 3", 6", 12", 18" Extensions
- Flexhead Ratchet
- Air Ratchet
- Impact Socket Sets (Standard and Metric)
- Impact Wrench
- Ratchet
- Spark Plug Sockets 5/8", 13/16"
- Speed Handle
- Universal Joint
- Flexible Socket Set 3/8" - 3/4"
- Flexible Socket Set 9mm - 19mm

Socket Set - 1/2" Drive:
- 7/16" - 1 1/8" Shallow Depth
- 7/16" - 1 1/8" Deep
- 10mm - 25mm Shallow Depth
- 10mm - 25mm Deep
- 3", 6", 12" Extensions
- Flex Handle (Breaker Bar)
- Impact Sockets 7/16" - 1 1/8"
- Impact Sockets 12mm - 32mm
- Impact Wrench
- Ratchet

Spark Plug Feeler Gauge (Gap Tool)
Tape Measure
Tire Pressure Gauge
Torque Wrench:
- 3/8" Drive (30 - 250 lb. in.)
- 3/8" Drive (5 - 75 lb. ft.)
- 1/2" Drive (50 - 250 lb. ft.)

Torx® Set
Wire Brush

GENERAL LAB/SHOP EQUIPMENT

The tools and equipment on this list are used in general lab/shop work but are not generally considered to be individual hand tools. A well equipped, certified program should have all of these general tools and equipment readily available and in sufficient quantity to provide quality instruction.

Air Chisel Set (various bits)
Air Compressor and Hoses
Axle Stands (Safety Stands)
Battery Charger
Belt Tension Gauge
Bench or Pedestal Grinder
Compression Tester
Computer Scan Tool (hand held) or Personal Computer (PC) with interface capability for on-board diagnostics (OBD II compliant recommended)
Cooling System Pressure Tester
Creeper
Cylinder Leakage Tester
Digital Multi-meter with various leadsets
Drain Pans
Drill - 3/8" variable speed, reversible
Drill - 1/2" variable speed, reversible
Engine Coolant Recovery/Recycler or Contract Service
Extension Cords
Fender Covers
Floor Jack (1½ Ton Minimum)
Fuel Reclaimer/Storage Unit; Gasoline/Diesel (strongly recommended)
Hand Held Vacuum Pump
Heat Gun or Equivalent
Hoist(s)
Jumper Cables
Oil Can - Pump Type
Oil Filter Wrench
Parts Cleaning Tank
Remote Starter Switch
Screw Extractor Set
Seat Covers
Snap Ring Pliers Set - external
Snap Ring Pliers Set - internal
Soldering Gun
Soldering Iron (25 Watt Pencil Tip)
Spark Plug Boot Puller

Steel Top Workbenches (with vises)
Tach/Dwell Meter
Tap and Die Set - Standard
Tap and Die Set - Metric
Thread Repair Insert Kit
Tire Inflator Chuck
Trouble/Work Lights (Fluorescent Preferred)
Tube Quick Disconnect Tool Set
Tubing Cutter/Flaring Set
Twist Drill Set - 1/64" - 1/2"
Valve Core Removing Tool
Waste Oil Receptacle (with extension neck and funnel)

SPECIALTY TOOLS AND EQUIPMENT

This section covers the tools and equipment a lab/shop should have for training in any given specialty area. This equipment is specialized and it must be available in the lab/shop. No specific type or brand names are identified because they will vary in each local situation.

ENGINE PERFORMANCE

Antifreeze Tester
Battery/Starter/Charging System Tester
Carburetor Plug and Angle Gauge Set
Computer Carburetor Tools
Cylinder Leakage Tester
Dual Trace Lab Scope - (strongly recommended)
Engine Analyzer - with scope (lab scope capability recommended)
Four Gas Exhaust Analyzer
Fuel Injector Cleaning Equipment
Fuel Pressure Gauge Set with adapters
Injector Pulse Tester
Logic Probe
Oxygen Sensor Socket
Sending Unit Socket
Spark Plug Thread Tap
Static Strap
Timing/Advance Light
Vacuum/Pressure Gauge

ELECTRICAL/ELECTRONIC SYSTEMS

Alternator Service Tools
Battery/Starter/Charging System Tester
Connector Pick Tool Set
Wire and Terminal Repair Kit (includes weather proof connectors)

CNG/LPG MAINTENANCE, DIAGNOSIS AND REPAIR

Drill Press (Recommended)
Grounding Straps/Cables
Hole Saws *
High Pressure Gauges:
- 500 psi
- 5,000 psi (CNG programs only)

Manometer:
- 0-5"H2O
- 0-25"H2O

Methane Detector - Portable
Oxyacetylene Torch (Recommended)
Notebook Computer (PC)
Tubing Benders
Tubing Deburring Tools
Welding Equipment * (Recommended)
Wire Cutter/Stripper

* Only for programs seeking certification in CNG or LPG Conversion/Installation.